ENTRY NO. 52

NAME OF MACHINE Groningen K160 Cyclotron
INSTITUTION Kernfysisch Versneller Instituut
ADDRESS Zernikelaan 25, 9747 AA Groningen (The Netherlands)
TEL 050-115700 TELEX
IN CHARGE R.H. Siemssen REPORTED BY H.W. Schreuder

HISTORY AND STATUS

DESIGN, date 1963 Model tests 1964 - 1966
ENG DESIGN, date 1966 - 1968
CONSTRUCTION, date 1968 - 1970
FIRST BEAM, date (or goal) 1970
MAJOR ALTERATIONS central region (1972)
axial injection (1983) (Ref: these proc.)
COST, ACCELERATOR 4.10^6
COST, FACILITY, total
FUNDED BY Groningen University

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 3 ENGINEERS 1
TECHNICIANS 10 CRAFTS 2
GRAD STUDENTS involved during year 1
OPERATED BY Research staff or 8 (half t)Operators
OPERATION ~130 hr/wk. On target ~110 hr./wk
TIME DISTR. in house 70 % Outside 30 %
BUDGET, op & dev
FUNDED BY Groningen University and foundation FOM

RESEARCH STAFF, not included above

USERS, in house 20 incl. grad. st. outside
GRAD STUDENTS involved during year 12
RESEARCH BUDGET, in house
FUNDED BY Groningen University and foundation FOM

MAGNET

POLE FACE, diameter (compact) 280 cm, R extraction 121 cm
R injection - cm
GAP, min 22.4 cm, Field 20 kG
min 45 cm, Field 10 kG } at 560000 Ampere turns
AVERAGE FIELD at R ext 16 kG
B max/ < B > 1.25
NUMBER OF SECTORS { compact 3 / separated } Spiral, max 56 deg
SECTOR ANGLE (SSC) - deg
TRIMMING COILS 12 concentric
5 harmonic + 2 bump coils
CONDUCTOR, material and type aluminium
STORED ENERGY (cryogenic) - MJ
POWER: main coils 360 max, kW; current stability < 10^{-5}
trimming coils 100 max, kW; current stability < 10^{-3}
WEIGHT: Fe 650 tons; coils 29 tons
COOLING system demin water
ION ENERGY (bending limit) E/A = 160 q^2/a^2 MEV/amu
(focusing limit) E/A = q/a MeV/amu

ACCELERATION SYSTEM

DEES, number 1 180 deg
BEAM APERTURE 2.5 cm; DC Bias ~700 kV
TUNED by, coarse moving short fine trim cap
RF 4.7 to 13.9 MHz, stable ± 5.10^{-6}
Orb F to 13.9 MHz
HARMONICS, RF/Orb F, used 1, 3
DEE—Gnd, max 70 kV, min gap 0.6 cm
STABILITY, (pk-pk noise)/(pk RF volt) 2.10^{-4}
ENERGY GAIN, max 140 kV/turn
RF PHASE, stable to ± - deg
RF POWEP input, max 150 kW
FREQUENCY MODULATION, rate - /s
modulator, type -
beam pulse, width -

VACUUM SYSTEM

OPERATING PRESSURE 1.10^{-6} (ext. src.) ~~xxxx~~ mbar
PUMPS, No, Type, Size 1 oil diffusion 4000 l/s
2 cryo (7000 l/s) total

ION SOURCES

internal Livingston; PIG
external ECR, pol ions (1985)

INJECTION SYSTEM

axial, hyperboloidal inflector

EXTRACTION SYSTEM

electrostatic and magnetic

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed - m²; movable 450 m²
TARGET STATIONS 10 in 7 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type QMG/2 (Q3D type)
COMPUTER model VAX 11-780, VAX 22-750, PDP 11-34 (Cycl)
OTHER FACILITIES large scatt. chamber, HI-detector, multiplicity filter, Sumspectrometer and BGO-Anti Compton spectrometers, Mini-Orange filters

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
P	12	65 MeV		
α	25	160 MeV		
^{16}O	5	40 MeV/amu		
^{40}Ar	5	12 MeV/amu		
SECONDARY		(part/s)		

BEAM PROPERTIES

MEASURED	CONDITIONS
PULSE WIDTH 4-40 RF deg	pμ A of MeV ions
PHASE EXC. max RF deg	pμ A of MeV ions
EXTRACT eff < 50 %	pμ A of MeV ions
RESOL ΔE/E 0.2 %	pμ A of MeV ions
EMITTANCE (π mm. mrad) 10 axial, 7 rad	pμ A of MeV

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 84 SOLID STATES PHYSICS } 10
BIOMEDICAL APPLICAT 6 ISOTOPE PRODUCTIONS }

REFERENCES/NOTES

1) O.C. Dermois, A.G. Drentje, H.W. Schreuder, IEEE Trans NS 26-2(1979)1992
2) W.K.v.Asselt, O.C. Dermois, A.G. Drentje, H.W. Schreuder, Proc. Ninth Int.Conf. Caen (1981)p.267

PLAN VIEW OF FACILITY, COMMENTS, ETC.